

Water-Related Research: Current and Future Projects at the Montana Water Center of the Montana University System

**Presentation to the Water Policy Interim Committee of
the 63rd Montana Legislature**

By Dr. Duncan T. Patten, Director of the Montana Water Center

September 9, 2013

Helena, Montana



Background of the Montana Water Center

- One of 54 institutions housed at Land Grant Universities across the country. The 54 institutions (often referred to as Water Resource Research Institutions) make up NIWR (National Institutes for Water Resources).**
- Founded by the passage of the 1964 Water Resources Research Act.**
- Established at Montana State University by edict of Governor**
- Duncan Patten (MSU), Director; John LaFave (MBMG/MT Tech), and William Woessner (UM) Associate Directors; Stephanie McGinnis (MSU), Assistant Director.**

Mission of the Montana Water Center

- Facilitate training of water scientists and engineers by supporting research throughout the Montana University System.**
- Information source about water in Montana through, in part, a regular newsletter.**
- Training and outreach through development of instructional programs for students, teachers, elected officials, and water and wetland professionals.**
- Coordinate and support the annual meeting of the Montana branch of the American Water Resources Association at which over 140 students, faculty, professionals and agency scientists attend.**

Funding for the Montana Water Center

- **Basic funding comes from the USGS 104b program as associated with annual funding of the Water Resources and Research Act.**
- **Funding has gradually declined: ca. \$92K in 2008-12, \$56K in 2013. All USGS 104b funds must be matched 2:1, non federal to federal.**
- **Grants and Federal Earmarks have supported several programs (see research and outreach section).**
- **No other state support (unlike most other states).**

Research and Outreach Programs Over the Past Several Years.

- Whirling Disease Research (completed 2009)**
- Native Fish Habitat Research (completed 2010)**
- Water/wastewater Treatment Training (completed 2011 and presently responding to EPA RFP)**
- Wetland Professional Training Courses: “Monitoring and Assessment of Wetlands” offered September 17-19, 2013 at MSU.**
- Participation in Annual Water School for water and wastewater treatment professionals (Bozeman October 1-3, 2013).**
- Annual meeting of the Montana branch of the AWRA. Theme “Water and Energy” (Bozeman October 2-4, 2013)**

Faculty Research Supported by Water Center (examples from 2013)

- Kevin Chandler (PI) and Jon Reiten, Montana Bureau of Mines and Geology, Billings Montana. 2013. "Methods for estimating wetland evapotranspiration through groundwater flow modeling of diurnal groundwater fluctuations".**
- Glen Shaw, Department of Geological Engineering, Montana Tech, Butte. 2013. Using ^{222}Rn and Isotopic Tracers to Trace Groundwater-Lake Interactions.**
- Geoffrey Poole, Department of Land Resources and Environmental Sciences, Montana State University, Bozeman. 2013. Assessing Hydrologic, Hyporheic, and Surface Water Temperature Responses to Stream Restoration.**
- Andrew Wilcox, Assistant Professor Department of Geosciences, University of Montana. 2013. Thresholds in fluvial systems: Flood-induced channel changes on Montana rivers.**

Three examples of faculty research that relate to groundwater.

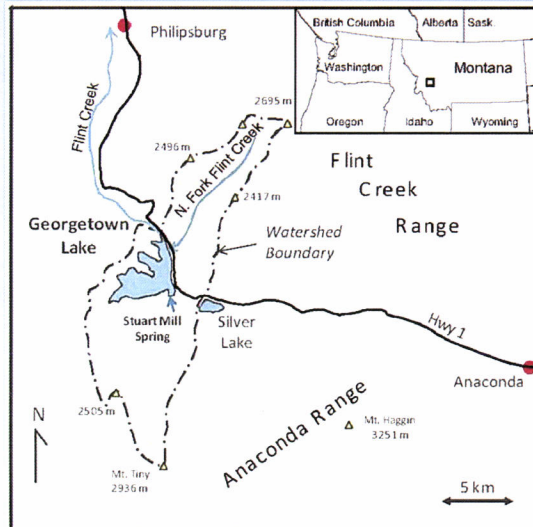
Understanding ground and surface water relationships is one way to:

- **Determine many of the hydrological processes around the state**

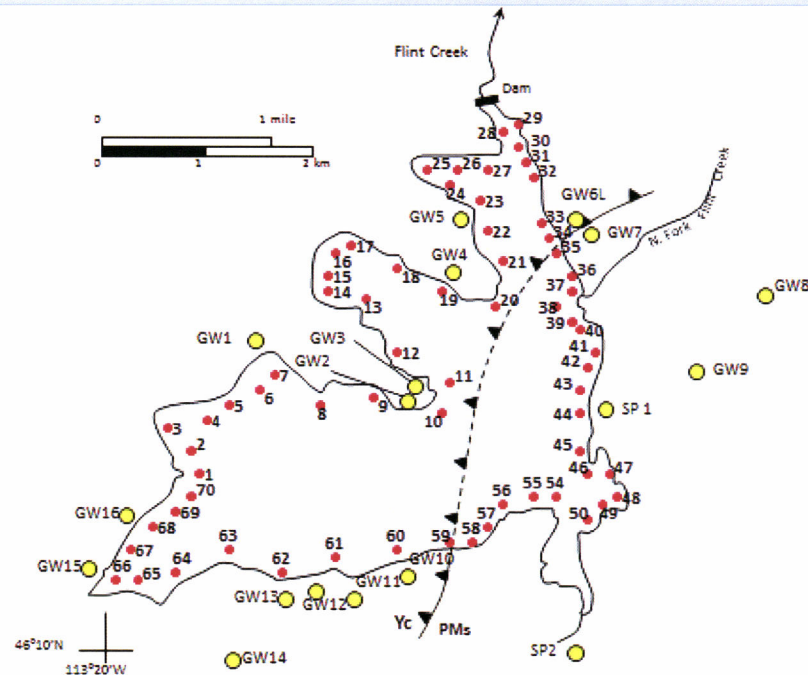
and

- **Understand how factors influencing one form of water may affect the other (e.g., groundwater withdrawals on stream flows).**

Glen Shaw, Department of Geological Engineering, Montana Tech, Butte. 2013.
Using ^{222}Rn and Isotopic Tracers to Trace Groundwater-Lake Interactions.



Map of the Georgetown Reservoir area relative to the state of Montana



Georgetown Lake. Lake (red circles) and groundwater/spring (yellow circles) sampling locations. The number by the sampling point represents the sample location ID..

Conclusions: There is currently no evidence that high levels of nutrients are entering the lake through groundwater inflows to the lake during late winter, but the conceptual understanding of groundwater flow suggests that groundwater pollution is a greater risk in the southeast portion of the reservoir.

Kevin Chandler (PI) and Jon Reiten, Montana Bureau of Mines and Geology, Billings Montana. 2013. "Methods for estimating wetland evapotranspiration through groundwater flow modeling of diurnal groundwater fluctuations".



Figure 7: Tarps installed around Gart 18 for the "tarp test" and Gart 17 control well in the distance, 9

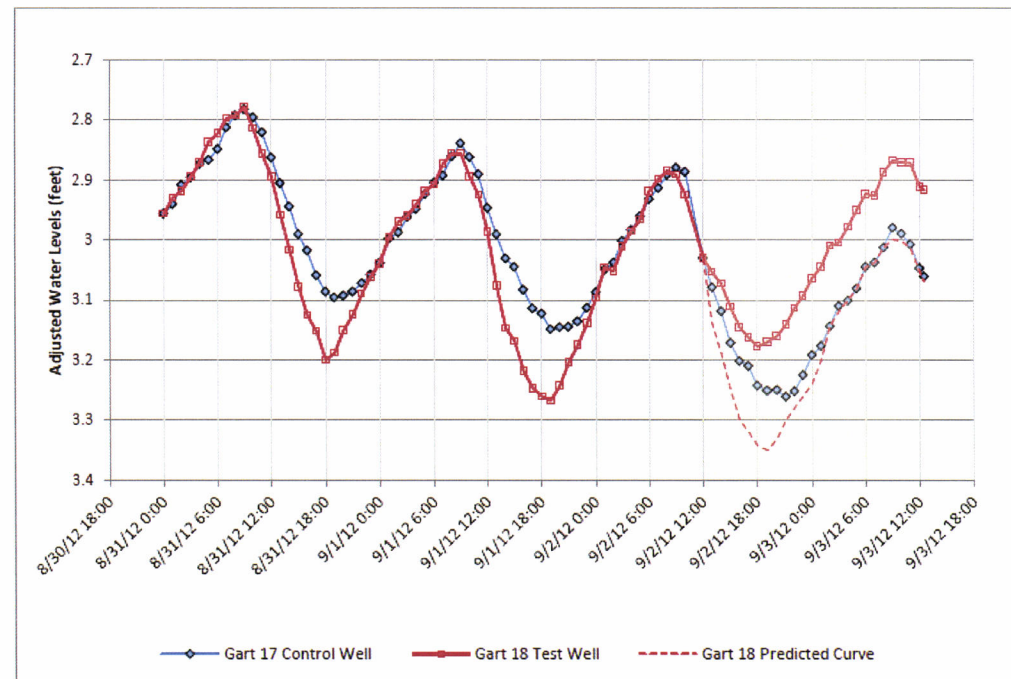
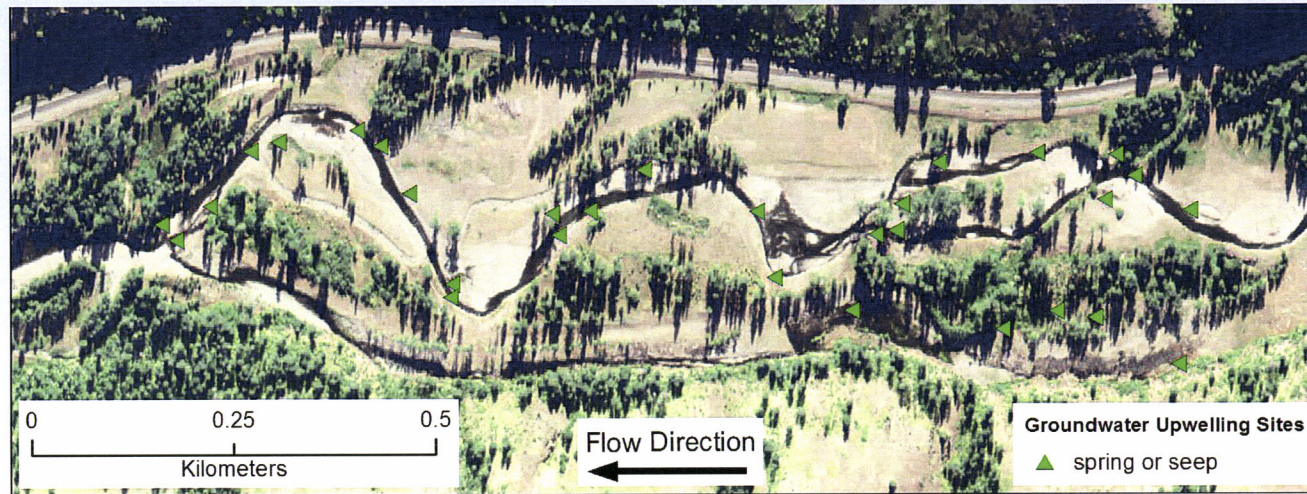


Figure 12: The water-level fluctuations in Gart 18 change in response to installation of 341 ft² of tarps around the well whereas the water-level fluctuations at Gart 17, the control well remain consistent. The actual water levels were adjusted to the same starting point on 8/31/2012 for comparison purposes. The shaded area shows the time when the tarp was installed.

Geoffrey Poole, Department of Land Resources and Environmental Sciences, Montana State University, Bozeman. 2013. Assessing Hydrologic, Hyporheic, and Surface Water Temperature Responses to Stream Restoration.



An actively flowing groundwater spring and seep (note filamentous algae growing in nutrient-rich outflow) along the restored reach of Meacham Creek in summer 2012.

Observation of over 25 groundwater **upwelling** features along the restored channel demonstrate that there has been a shift in groundwater hydrology at the restoration site. These features include a range of types from strongly flowing springs to seeps along the downstream margin of point bars marked by filamentous algae growing in these nutrient-enriched outflows.

Student Research Supported by Water Center (examples from 2013)

- Jared Bean, University of Montana. 2013. Evaluating hydrogeomorphic controls on bull trout spawning habitat in mountain streams, Northwestern Montana.
- Katie Davis, Montana State University. 2013. An Investigation of Natural Treatment Systems in Cold Climates: Wastewater Treatment at Bridger Bowl Update.
- Michael LeMoine, University of Montana. 2013. Invisible impacts of changing stream conditions: nongame fish assemblage response to changing stream temperatures.
- Anthony Thompson, University of Montana. 2013. Columbia River Treaty Renegotiation Process: Collaborative in Word and Deed.

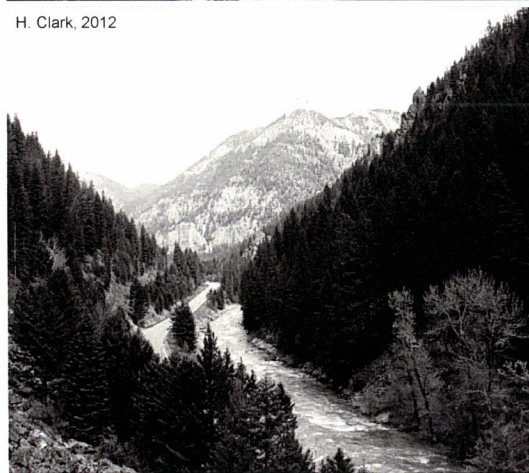
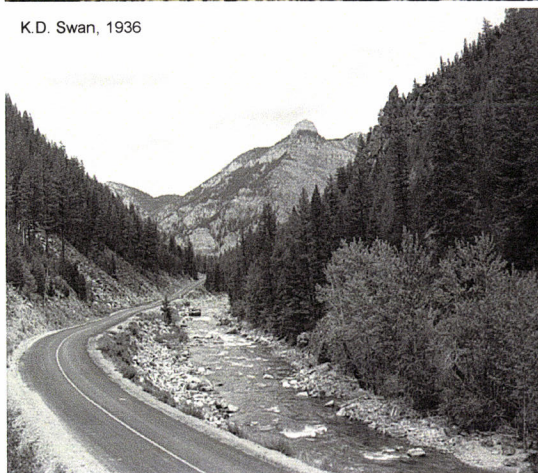
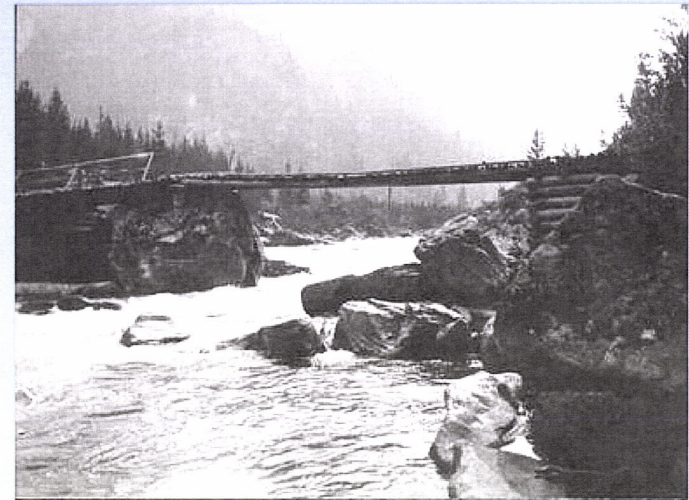
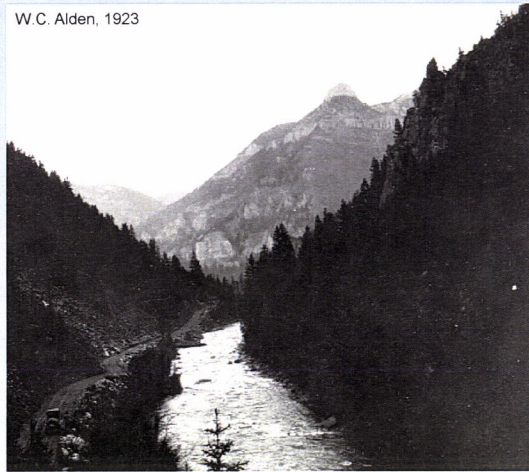
On-going Faculty Research Supported by the Water Center (2013-14) (One supported due to reduced budget).

Katie Hailer. Do Sediments in the Warm Springs Ponds Operable Unit Act as A Sink for Organic Wastewater Compounds?

On-going Student Research Supported by the Water Center (2013-14) (Four supported at \$1,000 each because of reduced budget... one example).

Heidi Clark, Montana State University, Bozeman. Student Fellowship: Rephotography as a tool to Understand the Effects of Resource Use on Rivers of the Greater Yellowstone Region.


Repeat Photography: A Useful Tool for Understanding Riverine Process for Management and Restoration



Looking north towards Storm Castle

Sheep bridge over House Rock on Gallatin River 1915 and Present

Effect of Highway Development in the Gallatin River Canyon

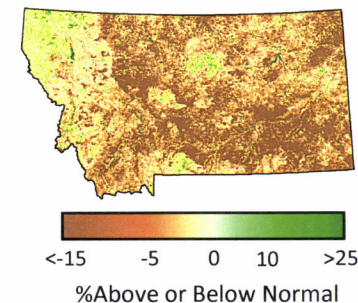


On-going and Future Goals of the Montana Water Center

Facilitate development of an “across state” searchable data base on local water conditions.

Example: Coordinated state mapping of surface and ground water and drought and vegetation conditions using data from existing sources (e.g., USGS surface water, NOAA climate data, state groundwater data from MBMG and state library, drought from Governors drought committee sources, vegetation conditions (via satellite) from UM scientists, climatic data from State Climate Center (UM) and climatologist.

First stage of this program would be to organize a panel/group/committee to identify (a) the real needs for this program, (b) existing data, and (c) potential for cooperation and data sharing among entities.



September 2012 satellite derived vegetation greenness depicted as percent above or below normal.

Facilitate and leverage water research and outreach opportunities related to some of the states critical water and resource issues

Examples:

Oil and natural gas exploration and effects of extraction and transport (e.g., groundwater use and produced water deposition and contamination of water sources, effects of pipelines on rivers). Working with MBMG Billings, The Center for Riverine Science and Stream Re-naturalization at UM, DNRC, DEQ and FWP .

Community preparation for extreme climate conditions: drought, flood, etc. Working with Watercourse which is within the Water Center, Montana Climate Center, DNRC and Governors Drought Committee

“Clean Coal” through enhancing below surface coal methanogenesis using produced water. Working with the Center for Biofilm Engineering at MSU Bozeman, and USGS.

Education, Outreach and Training Programs

- **Reestablish training materials programs for small system waste water and water operators.**

Thank you

**Questions and/or
Comments?**